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PORTABLE CAMERA AND WIRING HARNESS

BACKGROUND

Advances in recording technology and a growing interest in video and audio capture for a variety of applications has created a growing market for point-of-view cameras, which can be clipped to a user's helmet or other clothing item or to equipment. The point-of-view camera can then be used to record images that approximately match the user's perspective when engaged in an activity.

Current state-of-the-art technology re-purposes small (approximately 1"x 3") security cameras for use as portable point-of-view cameras. Such a camera is illustrated in FIG. 1 and includes the following major components: a camera including a lens 12, a lens cover 14, a charge-coupled device (CCD) 16, a signal processor 18, a printed circuit board (PCB) 20, and a casing 22; the camera is connected to a cable 24 to which a video terminal 26 and power terminal 28 are coupled.

The current state-of-the-art, point-of-view camera (*e.g.*, "helmet cam") is coupled with the recording device (*e.g.*, a camcorder) and other recording equipment, as illustrated in FIG. 2, *via* the following eight detachable connections:

1) Connector pair 31 couples the power supply 40 with a power splitter 42.
2) Connector pair 32 couples a camera 44 with the power splitter 42.
3) Connector pair 33 couples a microphone 46 with the power splitter 42.
4) Connector pair 34 includes a video connector 48 of an audio/video cable 50 coupled with the RCA terminal of a BNC-to-RCA adapter 52.
5) Connector pair 35 includes a connector on the camera's video output cable 54 coupled with the BNC terminal of the BNC-to-RCA adapter 52.
6) Connector pair 36 includes a connector extended from the microphone 46 coupled with an audio connector 56 of the audio/video cable 50.
7) Connector pair 37 couples the audio/video cable 50 with a camcorder 58.
8) Finally, connector pair 38 couples the camcorder 58 with a remote control 60.

The BNC-to-RCA adapter 52 is required because the security cameras that were utilized as point-of-view cameras included BNC output connectors.

SUMMARY

A wiring harness is herein described that can connect a camera, a power source and a recording device to enable transmission of power and electronic data signals therebetween with far fewer connections than have been employed in previous wiring configurations. The wiring harness includes a power cord having a connector that can be connected with the power supply, a recording cord having a connector that can be connected with a recording device, and a camera cord having a connector that can be connected with a camera. The camera cord is also coupled with the power cord so as to enable the camera to receive power from the power supply and with the recording cord so that the camera can transmit visual data from the camera to the recording device. Further still, a microphone can be integrated into the camera cord so that it can transmit audio signals to the recording device.

The camera can be mounted on a user's helmet, bicycle, weapon or other article of clothing or equipment (or directly to the user), and the user can then engage in an activity (*e.g.*, sport, observation, demonstration, surveillance, combat, or broadcast entertainment/performance) and have the camera record an audio and video stream that closely matches the user's experience and observations. Alternatively, the camera can be mounted to another animate or inanimate host (other than the user) to record from an alternative perspective.

Advantages offered by embodiments of the apparatus and methods of this disclosure (referred to herein as the "new design") over the current state-of-the-art apparatus, described above, include the following. The new design is better optimized for point-of-view camera applications and other uses. The reduced number of connections in the new design make the apparatus less confusing and cumbersome. The reduced number of connections, particularly between the recording device and the microphone and camera, also improves the integrity of signals transmitted to the recording device. A point-of-view camera utilizing the new design allows easy disconnection of the harness from the camera. Reduction in the number of separate components in the apparatus simplifies the system and reduces overall system weight and bulk. Fewer cables and reduced cable lengths in the new design can reduce the cable management problems that plagued the state-of-the-art apparatus. Multiple cable lengths can readily be provided via complementary use of an extension cord coupled with the camera. Finally, connection (*i.e.*, plug-type) converters are no longer necessary to enable coupling and communication between components joined by the wiring harness.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings, described below, like reference characters refer to the same or similar parts throughout the different views. The drawings are not necessarily to scale, emphasis instead being placed upon illustrating particular principles of the methods and apparatus characterized in the Detailed Description.

FIG. 1 is a disassembled view of an existing camera.

FIG. 2 is an image of an existing audio-video recording apparatus.

FIG. 3 is an image of an audio-video recording apparatus of this disclosure.

FIG. 4 is an illustration of one embodiment of a wiring harness of this disclosure.

FIG. 5 is an illustration of another embodiment of a wiring harness of this disclosure.

FIG. 6 is an illustration of an extension cord for the wiring harnesses of FIGS. 4 and 5.

FIG. 7 is an image of a point-of-view camera mounted to a helmet.

DETAILED DESCRIPTION

A wiring harness 73 including a camera cord 62, a power cord 64, and an audio-video recording cord 66 is coupled with a power supply 40, a recording device 72 and a point-of-view camera 70 in the embodiment illustrated in FIG. 3. A microphone 46 can be incorporated into the camera cord 62 so as to be able to capture sound and transmit corresponding audio signals from the microphone 46 through conductive wiring in the camera cord 62 to the recording device 72. An embodiment of the wiring harness 73 and related equipment is available from Viosport.com, Inc. of Marquette, Michigan, USA, with components manufactured by Sun Disk of Taiwan.

When designed for personal use (*i.e.*, when the camera and other components are afixed to the user), each of the cords 62, 64 and 66 has a length of not more than about 1.5 m. The wiring harness 73 operably joins system components via just three connections, one on each of the three cords 62, 64 and 66. At connection 39, a 4-pin mini-din female connector from the camera is connected with a 4-pin mini-din female connector on a terminal of the camera cord 62. At connection 31, a male 2.1 mm connector from the power supply 40 (in this case, a 12-V power source in the form of a battery pack holding eight AA batteries) is connected with a female 2.1 mm connector on a terminal of the power cord 64. At connection 38, a 3.5 mm male composite plug on a terminal of the recording cord 66 is connected with a 3.5 mm female input on a recording device 72; in this case, the recording cord 66 is connected to an analog input of a

hand-held video camera/recorder. The camera cord 62 is connected with both the power cord 64 and the recording cord 66, each at an opposite end from its connector.

The camera 70 is similar to the camera described in the background, except for the wiring and connectors. The camera 70 captures images and transmits electronic representations to the camera cord 62 of the wiring harness 73 through the camera's connector. In this embodiment, the camera 77 is a tubular-style camera that includes a ¼-inch color charge-coupled device (CCD) sensor from Panasonic. The CCD sensor converts the light pattern that is captured by the camera into electrical signals. The signal processor 18 and printed circuit board 20 (see FIG. 1) convert the signal from the CCD sensor 16 into a signal compatible with the recording device 72 via software written to produce the desired signal format. One embodiment of the camera is sold as the ADVENTURE CAM II by Viosport.com, Inc. (Marquette, Michigan, USA), and its technical specifications are as follows:

Pick-Up Element:	1/4" Panasonic Color CCD sensor
Number of Pixels:	512(H) x 492(V) / 512(H) x 582(V)
Resolution:	380 TV lines
Min. Illumination:	2 Lux / F2.0
S/N Ratio:	More than 48dB (AGC off)
Electronic Shutter:	1/60 (1/50) to 1/100,000 sec
White Balance:	Auto white balance
Auto Light Control:	3 windows detec
Load impedance:	75 ohms
Standard Board Lens:	f3.6mm / F2.0
Lens Angle:	70 degrees
Power Source:	DC12V +/- 10%
Dimension (mm):	26 (diameter) x 87 (length)
Current Consumption:	80 mA
Weight:	305 g
Cord Length:	2 inches (5 cm)
Cord Terminal:	water-tight mini-din 4-pin connection

The short cord length allows the user to disconnect the camera and wiring harness while keeping the camera attached to the helmet or other mounting area and also allows for multiple options in wiring configurations based on the terminals of the recording device. Further still, the short length of the cord from the camera easily enables coupling to cable extensions for longer runs.

Examples of wiring harnesses 73 and 73' including the camera cord 62, the power cord 64 and the recording cord 66 are illustrated in FIGS. 4 and 5. In each embodiment, a microphone 46 is incorporated into the camera cord 62 so as to be able to transmit audio signals generated in the microphone 46 through the camera cord 62. One embodiment of the microphone (manufactured by Sun Disk of Taiwan) has the following technical specifications:

Audio Output:	12 V p-p
Power Supply:	12 V DC
Power Consumption:	4 mA
Sensitivity:	58 dB
Resistance:	2.2 kΩ
Weight:	5 g
Width:	6.3 mm
Height:	29.1 mm

As shown, the power cord 64 connects with the power supply 40 via the power connector 78, which is a female 2.1 mm connector. The recording cord 66 is coupled with the recording device 72 via the recording connector 80, which in FIG. 4 is a 3.5 mm male composite plug (similar to a classic headphone jack). The wiring harness 73' of FIG. 5 is otherwise similar to that of FIG. 4, except the wiring harness 73' of FIG. 5 includes a pair of recording cables 66' and 66", one cable 66' having a male RCA video connector 80', the other cable 66" having a male RCA audio connector 80". When the camera is to be placed at a more-remote location (*e.g.*, mounted to the top tube, fork, or chain stay of a user's bicycle or to the hull of a user's kayak), an extension cord 82, illustrated in FIG. 6, can be connected with the camera cord 62. The extension cord 82 includes a female 4-pin mini-din connector 84 at one end for connecting with the connector 74 on the camera cord 62 and a male 4-pin mini-din connector 74' at its opposite end for connecting with the female mini-din connector on the camera 70.

The types of connectors utilized in these embodiments, however, are provided only by way of example as other types of connectors can be substituted to accommodate changes in the reciprocal connectors on the camera, recording device and/or power supply.

The camera 70 can be attached to a user's helmet 86 via a camera mount 88 secured to the helmet 86, as shown in FIG. 7. When mounted to the user's helmet 86, the camera 70 offers a point-of-view reference that closely matches that of the user (*i.e.*, the camera captures almost exactly what the user sees). Alternatively, the camera 70 can be attached to any other piece of equipment or article of clothing worn or operated by the user. Moreover, the camera can also simply be attached to the user's body, via a headband, for example.

The recording device 72 can be a portable video camera/recorder (camcorder), which is capable of recording live motion video and audio for later replay through videocassette recorders (VCR's), televisions or computers. Alternatively, the recording device 72 can be another type of compact, portable electronic device with a digital or analog storage medium, such as an MP3 player, a personal video player, or a portable hard drive. The power supply 40 can utilize standard batteries (*e.g.*, AA batteries) in a holder with electrical contacts for the batteries, or the power supply can be a rechargeable battery with a male 2.1 mm output connector. A suitable 12-volt rechargeable Li-Ion battery pack is available from Viosport.com, Inc.

With the camera 70 attached, *e.g.*, to the user's helmet, the power supply 40 and recording device 72 can be placed in the user's pockets or in a pack (*e.g.*, a backpack or hydration pack) worn by the user. A remote control 60 includes at least one button or other input means for controlling the recording device (*e.g.*, sending signals to record or stop). The remote control 60 plugs into a designated input on the recording 72 and the controller unit can be held in the user's hand or secured to the user's apparel or equipment for easy manual access by the user. A one-button remote control that works with any LANC-equipped camcorder is available from Viosport, Inc. LANC is a Sony remote control protocol found on select Canon, Sony and other camcorder models. The remote control includes a color LED indicator light; and its functions include power on/off, record, stop, and pause.

The user presses a button on the remote control 60 to commence recording of video and audio from the camera and microphone. Alternatively, the remote control 60 can be omitted from the apparatus, and the user can activate a "record" button on the recording device 72 (*e.g.*, a camcorder set to "VCR" mode) to commence recording. The recording device 72 can then

accept signals from the camera 70 and microphone 46. The camera 70 and microphone 46 draw power from the power source 40 to enable them to capture and transmit video and audio, respectively.

The camera 70, wiring harness 73, and other components can be utilized by a user in a wide variety of athletic activities to record, for example, a particular adventure, performance, demonstration or competition. Other applications include use, for example, by military personnel engaged in reconnaissance or combat; for environmental purposes (*e.g.*, observation or tracking of species) by a researcher; in vehicles or aircraft, where the camera is secured to the vehicle or aircraft; in forestry applications, where a forest ranger, for example, can readily record observations of the forest flora and fauna; for training purposes, where recordings can be made of instructional demonstrations or trainee performance; in covert or investigative operations, where the camera and microphone can be used to gather information; in security operations, where the camera and microphone can be used to monitor the premises; in search and rescue operations, where video and audio can be captured for evaluation and future training; in fire fighting, where recorded video and audio can be reviewed, *e.g.*, for performance evaluation and as an evidentiary record for investigating the nature and cause of fires; and by police to capture video and audio that can be used as evidence.

While this invention has been shown and described with references to particular embodiments thereof, those skilled in the art will understand that various changes in form and details may be made therein without departing from the scope of the invention, which is limited only by the following claims.